



58

## SEQUENCE LISTING

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Xing, Yongna

<120> Protein Knobs

<130> 268/279-RWJ-01-40

<140> 60/345,283

<141> 2001-11-08

<160> 56

<170> PatentIn version 3.1

<210> 1

<211> 92

<212> PRT

<213> Homo sapiens

<400> 1

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro

1 . . . . . 5 . . . . . 10 . . . . . 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys

. . . . . 20 . . . . . 25 . . . . . 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Leu

. . . . . 35 . . . . . 40 . . . . . 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser

. . . . . 50 . . . . . 55 . . . . . 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr

65 . . . . . 70 . . . . . 75

80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 . . . . . 90

<210> 2

<211> 92

<212> PRT

<213> Artificial Sequence

<220>

<223> hCG alpha-subunit with Cys substituted for Gln5

<400> 2

Ala	Pro	Asp	Val	Cys	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10					15

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55					60			

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His
Thr														
65					70					75				
80														

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser
				85					90		

<210> 3

<211> 92

<212> PRT

<213> Artificial Sequence

<220>

<223> hCG alpha-subunit with Cys substituted for Leu12

<400> 3

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Cys	Gln	Glu	Asn
Pro														
1				5					10					15

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55					60			

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65 70 75  
 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
 85 90

<210> 4  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Asn15

<400> 4

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Cys  
 Pro  
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
 Cys  
 20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
 Leu  
 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
 Ser  
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65 70 75  
 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
 85 90

<210> 5  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Phe17

<400> 5



75

90

90

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Cys Gln Glu Asn  
Pro

1		5		10		15								
Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	
Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		
Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55					60			
Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His
Thr														
65					70					75				
80														
Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser			
				85					90					

<210> 9  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Arg35

<400> 9

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5				10					15	
Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	
Phe	Ser	Cys	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		
Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55					60			

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65 70 75  
 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
 85 90

<210> 10  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Tyr37

<400> 10

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
 Pro  
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
 Cys  
 20 25 30

Phe Ser Arg Ala Cys Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
 Leu  
 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
 Ser  
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65 70 75  
 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
 85 90

<210> 11  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>

<223> hCG alpha-subunit with Cys substituted for Pro38

<400> 11

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10				15	

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20				25					30		

Phe	Ser	Arg	Ala	Tyr	Cys	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55					60			

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His
Thr														
65					70					75				
80														

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser
				85					90		

<210> 12

<211> 92

<212> PRT

<213> Artificial Sequence

<220>

<223> hCG alpha-subunit with Cys substituted for Thr39

<400> 12

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10				15	

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20				25					30		



Phe Ser Arg Ala Tyr Pro Cys Pro Leu Arg Ser Lys Lys Thr Met  
Leu

35

40

45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser

50

55

60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr

65

70

75

80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 13

<211> 92

<212> PRT

<213> Artificial Sequence

<220>

<223> hCG alpha-subunit with Cys substituted for Pro40

<400> 13

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro

1

5

10

15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys

20

25

30

Phe Ser Arg Ala Tyr Pro Thr Cys Leu Arg Ser Lys Lys Thr Met  
Leu

35

40

45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser

50

55

60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr

65  
80

70

75

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 14  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit with Cys substituted for Leu41

<400> 14

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Cys Arg Ser Lys Lys Thr Met  
Leu  
35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser  
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr  
65 70 75  
80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 15  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>

<223> hCG alpha-subunit with Cys substituted for Arg42

<400> 15

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10					15

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Cys	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55					60			

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His
Thr														
65					70					75				
80														

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser
				85					90		

<210> 16

<211> 92

<212> PRT

<213> Artificial Sequence

<220>

<223> hCG alpha-subunit with Cys substituted for Ser43

<400> 16

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10					15

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	



Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 18  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit with Cys substituted for Lys45

<400> 18

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Cys Thr Met  
Leu  
35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser  
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr  
65 70 75  
80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 19  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha subunit with Cys substituted for Thr46

<400> 19

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Cys Met  
Leu  
35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser  
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr  
65 70 75  
80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 20

<211> 92

<212> PRT

<213> Artificial Sequence

<220>

<223> hCG alpha-subunit with Cys substituted for Met47

<400> 20

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Cys  
Leu

35

40

45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser

50

55

60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr

65

70

75

80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

&lt;210&gt; 21

&lt;211&gt; 92

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; hCG alpha-subunit with Cys substituted for Leu48

&lt;400&gt; 21

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro

1

5

10

15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys

20

25

30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Cys

35

40

45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser

50

55

60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr

65

70

75

80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 22  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit with Cys substituted for Val49

<400> 22

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Leu  
35 40 45

Cys Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser  
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr  
65 70 75  
80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 23  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit with Cys substituted for Gln50

<400> 23



Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10					15

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val	Cys	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55					60			

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His
Thr														
65					70					75				
80														

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser
				85					90		

<210> 24  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Lys51

<400> 24

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10					15

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val Cys Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
 Ser  
     50                    55                    60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65                    70                    75  
 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser Ala Pro Asp  
 Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro  
 1                    5                    10                    15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
 Cys  
                     20                    25                    30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
 Leu  
                     35                    40                    45

Val Gln Cys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
 Ser  
     50                    55                    60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65                    70                    75  
 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
                     85                    90

<210> 25  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Asn52

<400> 25

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
 Pro

1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Leu  
35 40 45

Val Gln Lys Cys Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser  
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr  
65 70 75  
80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 26  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit with Cys substituted for Val53

<400> 26

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Leu  
35 40 45

Val	Gln	Lys	Asn	Cys	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55						60		

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His
Thr														
65					70					75				
80														

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser
				85					90		

<210> 27  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Glu56

<400> 27

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10					15

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val	Gln	Lys	Asn	Val	Thr	Ser	Cys	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55						60		

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His
Thr														
65					70					75				
80														

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser
				85					90		

<210> 28  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Ser64

<400> 28

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10					15

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Cys
Ser														
	50					55					60			

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His
Thr														
65					70					75				
80														

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser
				85					90		

<210> 29  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Val76

<400> 29

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10					15



50

55

60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65 70 75  
 80

Ala Cys His Cys Ser Cys Cys Tyr Tyr His Lys Ser  
 85 90

<210> 31  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Tyr88

<400> 31

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
 Pro  
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
 Cys  
 20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
 Leu  
 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
 Ser  
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65 70 75  
 80

Ala Cys His Cys Ser Thr Cys Cys Tyr His Lys Ser  
 85 90

<210> 32

<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit with Cys substituted for Leu89

<400> 32

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Leu  
35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser  
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr  
65 70 75  
80

Ala Cys His Cys Ser Thr Cys Tyr Cys His Lys Ser  
85 90

<210> 33  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit with Cys substituted for His90

<400> 33

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15



Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55					60			

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His
Thr														
65					70					75				
80														

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	Cys	Lys	Ser
				85					90		

<210> 34  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Lys91

<400> 34

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn
Pro														
1				5					10				15	

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys
Cys														
			20					25					30	

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met
Leu														
		35					40					45		

Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys
Ser														
	50					55					60			

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65 70 75  
 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Cys Ser  
 85 90

<210> 35  
 <211> 92  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG alpha-subunit with Cys substituted for Ser92

<400> 35

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
 Pro  
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
 Cys  
 20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
 Leu  
 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
 Ser  
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65 70 75  
 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Cys  
 85 90

<210> 36  
 <211> 145  
 <212> PRT

<213> Homo sapiens

<400> 36

Ser	Lys	Glu	Pro	Leu	Arg	Pro	Arg	Cys	Arg	Pro	Ile	Asn	Ala	Thr
Leu														
1				5					10					15

Ala	Val	Glu	Lys	Glu	Gly	Cys	Pro	Val	Cys	Ile	Thr	Val	Asn	Thr
Thr														
			20					25					30	

Ile	Cys	Ala	Gly	Tyr	Cys	Pro	Thr	Met	Thr	Arg	Val	Leu	Gln	Gly
Val														
		35					40					45		

Leu	Pro	Ala	Leu	Pro	Gln	Val	Val	Cys	Asn	Tyr	Arg	Asp	Val	Arg
Phe														
	50					55					60			

Glu	Ser	Ile	Arg	Leu	Pro	Gly	Cys	Pro	Arg	Gly	Val	Asn	Pro	Val
Val														
65					70					75				
80														

Ser	Tyr	Ala	Val	Ala	Leu	Ser	Cys	Gln	Cys	Ala	Leu	Cys	Arg	Arg
Ser														
				85					90					95

Thr	Thr	Asp	Cys	Gly	Gly	Pro	Lys	Asp	His	Pro	Leu	Thr	Cys	Asp
Asp														
			100					105					110	

Pro	Arg	Phe	Gln	Asp	Ser	Ser	Ser	Ser	Lys	Ala	Pro	Pro	Pro	Ser
Leu														
		115					120					125		

Pro	Ser	Pro	Ser	Arg	Leu	Pro	Gly	Pro	Ser	Asp	Thr	Pro	Ile	Leu
Pro	Gln													
	130					135					140			

<210> 37

<211> 145

<212> PRT

<213> Artificial Sequence

<220>

<223> hCG beta-subunit with Cys substituted for Ser138

<400> 37

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
Leu  
1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
Thr  
20 25 30

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
Val  
35 40 45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
Phe  
50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val  
Val  
65 70 75  
80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg  
Ser  
85 90 95

Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp  
Asp  
100 105 110

Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser  
Leu  
115 120 125

Pro Ser Pro Ser Arg Leu Pro Gly Pro Cys Asp Thr Pro Ile Leu  
Pro Gln  
130 135 140

<210> 38

<211> 145

<212> PRT

<213> Artificial Sequence

<220>

<223> hCG beta-subunit residues 101-114 were replaced with their hFSH b

eta-subunit counterparts, namely hFSH beta-subunit residues 95-10

8

<400> 38

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
Leu  
1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
Thr  
20 25 30

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
Val  
35 40 45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
Phe  
50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val  
Val  
65 70 75  
80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg  
Ser  
85 90 95

Thr Thr Asp Cys Thr Val Arg Gly Leu Gly Pro Ser Tyr Cys Ser  
Phe  
100 105 110

Gly Glu Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser  
Leu  
115 120 125

Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu  
 Pro Gln  
 130 135 140

<210> 39  
 <211> 145  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG beta-subunit residues 101-114 were replaced with  
 their hFSH b  
 eta-subunit counterparts, namely hFSH beta-subunit  
 residues 95-10  
 8, and Serine38 in the beta-subunit carboxyterminus  
 of this  
 analog was replaced with Cys

<400> 39

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
 Leu  
 1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
 Thr  
 20 25 30

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
 Val  
 35 40 45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
 Phe  
 50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val  
 Val  
 65 70 75  
 80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg  
 Ser  
 85 90 95

Thr Thr Asp Cys Thr Val Arg Gly Leu Gly Pro Ser Tyr Cys Ser  
 Phe

	100		105		110
Gly Glu Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser					
Leu					
	115		120		125
Pro Ser Pro Ser Arg Leu Pro Gly Pro Cys Asp Thr Pro Ile Leu					
Pro Gln					
	130		135		140
<210> 40					
<211> 111					
<212> PRT					
<213> Homo sapiens					
<400> 40					
Asn Ser Cys Glu Leu Thr Asn Ile Thr Ile Ala Val Glu Lys Glu					
Gly					
1		5		10	15
Cys Gly Phe Cys Ile Thr Ile Asn Thr Thr Trp Cys Ala Gly Tyr					
Cys					
	20		25		30
Tyr Thr Arg Asp Leu Val Tyr Lys Asp Pro Ala Arg Pro Lys Ile					
Gln					
	35		40		45
Lys Thr Cys Thr Phe Lys Glu Leu Val Tyr Glu Thr Val Arg Val					
Pro					
	50		55		60
Gly Cys Ala His His Ala Asp Ser Leu Tyr Thr Tyr Pro Val Ala					
Thr					
65		70		75	
80					
Gln Cys His Cys Gly Lys Cys Asp Ser Asp Ser Thr Asp Cys Thr					
Val					
	85		90		95
Arg Gly Leu Gly Pro Ser Tyr Cys Ser Phe Gly Glu Met Lys Glu					
	100		105		110

<210> 41  
<211> 139  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hFSH beta-subunit analog lacking the leader peptide  
of hFSH beta-  
subunit with hFSH residues 1-108 and hCG residues  
115-145 in  
tandem

<400> 41

Asn	Ser	Cys	Glu	Leu	Thr	Asn	Ile	Thr	Ile	Ala	Val	Glu	Lys	Glu
Gly														
1				5					10					15

Cys	Gly	Phe	Cys	Ile	Thr	Ile	Asn	Thr	Thr	Trp	Cys	Ala	Gly	Tyr
Cys														
			20					25					30	

Tyr	Thr	Arg	Asp	Leu	Val	Tyr	Lys	Asp	Pro	Ala	Arg	Pro	Lys	Ile
Gln														
		35					40					45		

Lys	Thr	Cys	Thr	Phe	Lys	Glu	Leu	Val	Tyr	Glu	Thr	Val	Arg	Val
Pro														
	50					55					60			

Gly	Cys	Ala	His	His	Ala	Asp	Ser	Leu	Tyr	Thr	Tyr	Pro	Val	Ala
Thr														
65					70					75				
80														

Gln	Cys	His	Cys	Gly	Lys	Cys	Asp	Ser	Asp	Ser	Thr	Asp	Cys	Thr
Val														
				85					90				95	

Arg	Gly	Leu	Gly	Pro	Ser	Tyr	Cys	Ser	Phe	Gly	Glu	Phe	Gln	Asp
Ser														
			100					105					110	

Ser	Ser	Ser	Lys	Ala	Pro	Pro	Pro	Ser	Leu	Pro	Ser	Pro	Ser	Arg
Leu														
			115					120				125		



Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln  
 130 135

<210> 42  
 <211> 137  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hFSH beta-subunit analog lacking the leader peptide  
 of hFSH beta-  
 subunit with hFSH residues 1-108 and hCG residues  
 115-145 in tandem and with Ser132 replaced with Cys

<400> 42

Asn Ser Cys Glu Leu Thr Asn Ile Thr Ile Ala Val Glu Lys Glu  
 Gly  
 1 5 10 15

Cys Gly Phe Cys Ile Thr Ile Asn Thr Thr Trp Cys Ala Gly Tyr  
 Cys  
 20 25 30

Tyr Thr Arg Asp Leu Val Tyr Lys Asp Pro Ala Arg Pro Lys Ile  
 Gln  
 35 40 45

Lys Thr Cys Thr Phe Lys Glu Leu Val Tyr Glu Thr Val Arg Val  
 Pro  
 50 55 60

Gly Cys Ala His His Ala Asp Ser Leu Tyr Thr Tyr Pro Val Ala  
 Thr  
 65 70 75  
 80

Gln Cys His Cys Gly Lys Cys Asp Ser Asp Ser Thr Asp Cys Thr  
 Val  
 85 90 95

Arg Gly Leu Gly Pro Ser Tyr Cys Ser Phe Gly Glu Phe Gln Asp  
 Ser  
 100 105 110



Thr Asp	Thr	Asp	Cys	Gly	Gly	Pro	Lys	Asp	His	Pro	Leu	Thr	Cys	Asp	
			100					105					110		
Pro Leu	Arg	Phe	Gln	Asp	Ser	Ser	Ser	Ser	Lys	Ala	Pro	Pro	Pro	Ser	
		115						120					125		
Pro Leu	Ser	Pro	Ser	Arg	Leu	Pro	Gly	Pro	Cys	Asp	His	Pro	Glu	Thr	
	130						135					140			
Val Tyr 145 160	Lys	Val	Lys	Asp	Ala	Glu	Asp	Gln	Leu	Gly	Ala	Arg	Val	Gly	
					150					155					
Ile Pro	Glu	Leu	Asp	Leu	Asn	Ser	Gly	Lys	Ile	Leu	Glu	Ser	Phe	Arg	
				165					170					175	
Glu Gly	Glu	Arg	Phe	Pro	Met	Met	Ser	Thr	Phe	Lys	Val	Leu	Leu	Cys	
			180						185					190	
Ala Arg	Val	Leu	Ser	Arg	Ile	Asp	Ala	Gly	Gln	Glu	Gln	Leu	Gly	Arg	
		195						200					205		
Ile Glu	His	Tyr	Ser	Gln	Asn	Asp	Leu	Val	Glu	Tyr	Ser	Pro	Val	Thr	
	210						215					220			
Lys Ala 225 240	His	Leu	Thr	Asp	Gly	Met	Thr	Val	Arg	Glu	Leu	Cys	Ser	Ala	
					230					235					
Ile Ile	Thr	Met	Ser	Asp	Asn	Thr	Ala	Ala	Asn	Leu	Leu	Leu	Thr	Thr	
				245					250					255	
Gly His	Gly	Pro	Lys	Glu	Leu	Thr	Ala	Phe	Leu	His	Asn	Met	Gly	Asp	

	260		265		270
Val Thr Arg Leu Asp Arg Trp Glu Pro Glu Leu Asn Glu Ala Ile					
Pro					
	275		280		285
Asn Glu Arg Asp Thr Thr Met Pro Val Ala Met Ala Thr Thr Leu					
Arg					
	290		295		300
Lys Leu Leu Thr Gly Glu Leu Leu Thr Leu Ala Ser Arg Gln Gln					
Leu					
305		310		315	
320					
Ile Asp Trp Met Glu Ala Asp Lys Val Ala Gly Pro Leu Leu Arg					
Ser					
		325		330	335
Ala Leu Pro Ala Gly Trp Phe Ile Ala Asp Lys Ser Gly Ala Gly					
Glu					
	340		345		350
Arg Gly Ser Arg Gly Ile Ile Ala Ala Leu Gly Pro Asp Gly Lys					
Pro					
	355		360		365
Ser Arg Ile Val Val Ile Tyr Thr Thr Gly Ser Gln Ala Thr Met					
Asp					
	370		375		380
Glu Arg Asn Arg Gln Ile Ala Glu Ile Gly Ala Ser Leu Ile Lys					
His					
385		390		395	
400					

Trp

<210> 44  
 <211> 408  
 <212> PRT  
 <213> Artificial Sequence

<220>

<223> hCgbeta,S138C-betaLA(long), beta-lactamase fused to  
the carboxy-  
terminal end of hCgb,S138C

<400> 44

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
Leu  
1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
Thr  
20 25 30

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
Val  
35 40 45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
Phe  
50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val  
Val  
65 70 75  
80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg  
Ser  
85 90 95

Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp  
Asp  
100 105 110

Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser  
Leu  
115 120 125

Pro Ser Pro Ser Arg Leu Pro Gly Pro Cys Asp Thr Pro Ile Leu  
Pro  
130 135 140

Gln His Pro Glu Thr Leu Val Lys Val Lys Asp Ala Glu Asp Gln  
Leu





	35		40		45
Leu	Pro	Ala	Leu	Pro	Gln
Phe			Val	Val	Cys
	50		55		60
Glu	Ser	Ile	Arg	Leu	Pro
Val				Gly	Cys
65			70		75
80					
Ser	Tyr	Ala	Val	Ala	Leu
Ser				Ser	Cys
			85		90
					95
Thr	Thr	Asp	Cys	Gly	Gly
Asp				Pro	Lys
			100		105
					110
Pro	Arg	Phe	Gly	Pro	Cys
		115		Asp	Thr
					120
<210>	46				
<211>	130				
<212>	PRT				
<213>	Artificial Sequence				
<220>					
<223>	hCGbeta,delta121-135,S138C				
<400>	46				
Ser	Lys	Glu	Pro	Leu	Arg
Leu				Pro	Arg
1			5		10
					15
Ala	Val	Glu	Lys	Glu	Gly
Thr				Cys	Pro
			20		25
					30
Ile	Cys	Ala	Gly	Tyr	Cys
Val				Pro	Thr
			35		40
					45



Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
Phe  
50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val  
Val  
65 70 75  
80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg  
Ser  
85 90 95

Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp  
Asp  
100 105 110

Pro Arg Phe Gln Asp Ser Ser Ser Gly Pro Cys Asp Thr Pro Ile  
Leu  
115 120 125

Pro Gln

<210> 47  
<211> 136  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCGbeta,delta126-135,S138C

<400> 47

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
Leu  
1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
Thr  
20 25 30

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
Val  
35 40 45

Leu	Pro	Ala	Leu	Pro	Gln	Val	Val	Cys	Asn	Tyr	Arg	Asp	Val	Arg
Phe														
	50					55					60			

Glu	Ser	Ile	Arg	Leu	Pro	Gly	Cys	Pro	Arg	Gly	Val	Asn	Pro	Val
Val														
65					70					75				
80														

Ser	Tyr	Ala	Val	Ala	Leu	Ser	Cys	Gln	Cys	Ala	Leu	Cys	Arg	Arg
Ser														
				85					90				95	

Thr	Thr	Asp	Cys	Gly	Gly	Pro	Lys	Asp	His	Pro	Leu	Thr	Cys	Asp
Asp														
			100					105					110	

Pro	Arg	Phe	Gln	Asp	Ser	Ser	Ser	Ser	Lys	Ala	Pro	Pro	Pro	Gly
Pro														
		115					120					125		

Cys	Asp	Thr	Pro	Ile	Leu	Pro	Gln
130						135	

<210> 48  
 <211> 140  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCGBeta,delta131-135,S138C

<400> 48

Ser	Lys	Glu	Pro	Leu	Arg	Pro	Arg	Cys	Arg	Pro	Ile	Asn	Ala	Thr
Leu														
1				5				10					15	

Ala	Val	Glu	Lys	Glu	Gly	Cys	Pro	Val	Cys	Ile	Thr	Val	Asn	Thr
Thr														
			20					25					30	

Ile	Cys	Ala	Gly	Tyr	Cys	Pro	Thr	Met	Thr	Arg	Val	Leu	Gln	Gly
Val														
	35						40					45		

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
Phe  
50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val  
Val  
65 70 75  
80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg  
Ser  
85 90 95

Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp  
Asp  
100 105 110

Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser  
Leu  
115 120 125

Pro Ser Gly Pro Cys Asp Thr Pro Ile Leu Pro Gln  
130 135

<210> 49  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit, Lys91 replaced with Glu

<400> 49

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Leu

35

40

45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser

50

55

60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr

65

70

75

80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Glu Ser  
85 90

&lt;210&gt; 50

&lt;211&gt; 92

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

&lt;223&gt; hCG alpha-subunit loop 2, Lys91 replaced with Met

&lt;400&gt; 50

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro

1

5

10

15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys

20

25

30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Leu

35

40

45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser

50

55

60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr

65

70

75

80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Met Ser  
85 90

<210> 51  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit loop 2, Lys44 replaced with Ala

<400> 51

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Ala Lys Thr Met  
Leu  
35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser  
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr  
65 70 75  
80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

<210> 52  
<211> 92  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG alpha-subunit loop 2, Lys44 replaced with Glu and  
Lys45 repla  
ced with Gln



35

40

45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser

50

55

60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr

65

70

75

80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
85 90

&lt;210&gt; 54

&lt;211&gt; 139

&lt;212&gt; PRT

&lt;213&gt; Artificial Sequence

&lt;220&gt;

<223> hCG analog - beta101-145, alpha, residues 3-100  
deleted from hCG

beta-subunit with alpha-subunit fused to the end of  
the remaining  
beta-subunit

&lt;400&gt; 54

Ser Lys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp Pro  
Arg

1

5

10

15

Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu Pro  
Ser

20

25

30

Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln  
Ala

35

40

45

Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro  
Phe

50

55

60

Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys  
Phe

65  
80

70

75

Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu  
Val

85

90

95

Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser  
Tyr

100

105

110

Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr  
Ala

115

120

125

Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
130 135

<210> 55  
<211> 31  
<212> PRT  
<213> Homo sapiens

<400> 55

Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu Pro  
Ser  
1 5 10 15

Pro Ser Arg Leu Pro Gly Pro Ser Thr Asp Pro Ile Leu Pro Gly  
20 25 30

<210> 56  
<211> 10  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> Xl-Asp-Asp-Asp-Asp-Lys-Ser-Ym-Cys-Zn, where X, Y, and  
Z refer to  
any tail portion amino acids and l, m, and n refer to  
the lengths  
of the tail portion amino acids

<220>  
<221> MISC\_FEATURE



<223> Xaa refers to any tail portion amino acids and n  
refers to the  
lengths of the tail portion amino acids

<400> 56

Xaan Asp Asp Asp Asp Lys Ser Xaan Cys Xaan  
1 5 10

<210> 57

<211> 92

<212> PRT

<213> Artificial Sequence

<220>

<223> An hCG truncated (-subunit analog fused to the hCG  
alpha-carboxyterminus

<400> 57

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Leu  
35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser  
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr  
65 70 75  
80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser Asp Asp Pro  
Arg  
85 90 95

Phe Gly Pro Cys Asp Thr Pro Ile Leu Pro Gln  
100 105

<210> 58

<211> 145

<212> PRT

<213> Artificial Sequence

<220>

<223> hCG beta-subunit with Cys substituted for Arg94

<400> 58

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
Leu  
1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
Thr  
20 25 30

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
Val  
35 40 45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
Phe  
50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val  
Val  
65 70 75  
80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Cys Arg  
Ser  
85 90 95

Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp  
Asp  
100 105 110

Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser  
Leu  
115 120 125

Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu  
Pro Gln  
130 135 140

<210> 59  
<211> 145  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG beta-subunit with Cys substituted for Arg95

<400> 59

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
Leu  
1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
Thr  
20 25 30

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
Val  
35 40 45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
Phe  
50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val  
Val  
65 70 75  
80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Cys  
Ser  
85 90 95

Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp  
Asp  
100 105 110

Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser  
Leu  
115 120 125

Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu  
Pro Gln  
130 135 140

<210> 60  
<211> 145  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG beta-subunit with Cys substituted for Ser96

<400> 60

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
Leu  
1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
Thr  
20 25 30

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
Val  
35 40 45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
Phe  
50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val  
Val  
65 70 75  
80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg  
Cys  
85 90 95

Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp  
Asp  
100 105 110

Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser  
Leu  
115 120 125

Pro	Ser	Pro	Ser	Arg	Leu	Pro	Gly	Pro	Ser	Asp	Thr	Pro	Ile	Leu
Pro	Gln													
	130					135						140		

<210> 61  
 <211> 145  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG beta-subunit with Cys substituted for Thr97

<400> 61

Ser	Lys	Glu	Pro	Leu	Arg	Pro	Arg	Cys	Arg	Pro	Ile	Asn	Ala	Thr
Leu														
1				5					10					15

Ala	Val	Glu	Lys	Glu	Gly	Cys	Pro	Val	Cys	Ile	Thr	Val	Asn	Thr
Thr														
			20					25					30	

Ile	Cys	Ala	Gly	Tyr	Cys	Pro	Thr	Met	Thr	Arg	Val	Leu	Gln	Gly
Val														
	35						40					45		

Leu	Pro	Ala	Leu	Pro	Gln	Val	Val	Cys	Asn	Tyr	Arg	Asp	Val	Arg
Phe														
	50					55					60			

Glu	Ser	Ile	Arg	Leu	Pro	Gly	Cys	Pro	Arg	Gly	Val	Pro	Asn	Val
Val														
65					70					75				
80														

Ser	Tyr	Ala	Val	Ala	Leu	Ser	Cys	Gln	Cys	Ala	Leu	Cys	Arg	Arg
Ser														
			85						90					95

Cys	Thr	Asp	Cys	Gly	Gly	Pro	Lys	Asp	His	Pro	Leu	Thr	Cys	Asp
Asp														
			100					105					110	

Pro	Arg	Phe	Gln	Asp	Ser	Ser	Ser	Ser	Lys	Ala	Pro	Pro	Pro	Ser
Leu														
		115						120					125	

Pro	Ser	Pro	Ser	Arg	Leu	Pro	Gly	Pro	Ser	Asp	Thr	Pro	Ile	Leu
Pro	Gln													
	130					135						140		

<210> 62  
 <211> 145  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG beta-subunit with Cys substituted for Thr98

<400> 62

Ser	Lys	Glu	Pro	Leu	Arg	Pro	Arg	Cys	Arg	Pro	Ile	Asn	Ala	Thr
Leu														
1				5					10					15

Ala	Val	Glu	Lys	Glu	Gly	Cys	Pro	Val	Cys	Ile	Thr	Val	Asn	Thr
Thr														
			20					25					30	

Ile	Cys	Ala	Gly	Tyr	Cys	Pro	Thr	Met	Thr	Arg	Val	Leu	Gln	Gly
Val														
	35						40					45		

Leu	Pro	Ala	Leu	Pro	Gln	Val	Val	Cys	Asn	Tyr	Arg	Asp	Val	Arg
Phe														
	50					55					60			

Glu	Ser	Ile	Arg	Leu	Pro	Gly	Cys	Pro	Arg	Gly	Val	Pro	Asn	Val
Val														
65					70					75				
80														

Ser	Tyr	Ala	Val	Ala	Leu	Ser	Cys	Gln	Cys	Ala	Leu	Cys	Arg	Arg
Ser														
			85						90					95

Thr	Cys	Asp	Cys	Gly	Gly	Pro	Lys	Asp	His	Pro	Leu	Thr	Cys	Asp
Asp														
			100					105					110	

Pro	Arg	Phe	Gln	Asp	Ser	Ser	Ser	Ser	Lys	Ala	Pro	Pro	Pro	Ser
Leu														
		115					120					125		

Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu  
 Pro Gln  
           130                          135                          140

<210> 63  
 <211> 145  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> hCG beta-subunit with Cys substituted for Asp99

<400> 63

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
 Leu  
 1                          5                          10                          15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
 Thr  
                           20                          25                          30

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
 Val  
                           35                          40                          45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
 Phe  
           50                          55                          60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val  
 Val  
 65                          70                          75  
 80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg  
 Ser  
                           85                          90                          95

Thr Thr Cys Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp  
 Asp  
                           100                          105                          110

Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser  
 Leu

115

120

125

Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu  
 Pro Gln  
           130                          135                          140

&lt;210&gt; 64

&lt;211&gt; 95

&lt;212&gt; PRT

&lt;213&gt; Artifical Sequence

&lt;220&gt;

<223> An hCG alpha-subunit analog with Gly-Gly-Cys at its  
 carboxyterminus

&lt;400&gt; 64

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
 Pro  
 1                          5                          10                          15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
 Cys  
                           20                          25                          30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
 Leu  
                           35                          40                          45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
 Ser  
           50                          55                          60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
 Thr  
 65                          70                          75  
 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser Gly Gly Cys  
 86 90                          95

&lt;210&gt; 65

&lt;211&gt; 92

&lt;212&gt; PRT

&lt;213&gt; Artifical Sequence

&lt;220&gt;

<223> An hCG alpha-subunit analog with Asp in place of  
 Asn52 and Cys in place of Ser92

&lt;400&gt; 65



Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn  
Pro  
1 5 10 15  
Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys  
Cys  
20 25 30  
Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met  
Leu  
35 40 45  
Val Gln Lys Asp Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys  
Ser  
50 55 60  
Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His  
Thr  
65 70 75  
80  
Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser  
87 90

<210> 66  
<211> 145  
<212> PRT  
<213> Artificial Sequence

<220>  
<223> hCG beta-subunit with Cys substituted for Ser96 and  
hFSH beta-subunit residues 95-108 for hCG beta-subunit  
residues 101-108

<400> 66

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr  
Leu  
1 5 10 15  
Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr  
Thr  
20 25 30  
Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly  
Val  
35 40 45  
Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg  
Phe

	50		55		60										
Glu	Ser	Ile	Arg	Leu	Pro	Gly	Cys	Pro	Arg	Gly	Val	Pro	Asn	Val	
Val															
65					70					75					
80															
Ser	Tyr	Ala	Val	Ala	Leu	Ser	Cys	Gln	Cys	Ala	Leu	Cys	Arg	Arg	
Cys															
				85					90					95	
Thr	Thr	Asp	Cys	Thr	Val	Arg	Gly	Leu	Gly	Pro	Ser	Tyr	Cys	Ser	
Phe															
				100				105					110		
Gly	Glu	Phe	Gln	Asp	Ser	Ser	Ser	Ser	Lys	Ala	Pro	Pro	Pro	Ser	
Leu															
			115					120					125		
Pro	Ser	Pro	Ser	Arg	Leu	Pro	Gly	Pro	Ser	Asp	Thr	Pro	Ile	Leu	
Pro	Gln														
	130					135					140				